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PHOTOGRAPHIC INTELLIGENCE REPORT

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GRIFFON MISSILE VARIANTS

PHOTOGRAPHIC AND MENSURAL ANALYSIS

DECLASS REVIEW by NIMA/DOD

CIA/PIR 61109

DATE April 1966

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Approved For Release 2006/02/07 : CIA-RDP02T06408R001200010011-5

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TITLE

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GRIFFON MISSILE VARIANTS (Photographic and Mensural Analysis)

INTRODUCTION

Analysis of Moscow Parade photography of the GRIFFON missile has revealed the existence of two basic types of GRIFFON. This report presents a photographic analysis of the two variants, and a detailed mensural study, based on a

greatly improved metrical data base now being utilized by NPIC/Technical Intelligence Division. A general description of the mensural techniques utilized is included also.

GENERAL INFORMATION

An analysis of the GRIFFON missiles shown thus far in the Moscow Parades has revealed a number of external modifications which can be related to two basic types or variants of GRIFFON. Within this report, these variants are referred to as GRIFFON (I) and GRIFFON (II).

Both variants have been present in each parade since GRIFFON was first unveiled in [redacted]. The number and relative position of the two variants within the parade order appears to be completely random, thus nothing is recognizable from this arrangement to suggest that certain units may be equipped with one variant or the other. No insignia has been identified on GRIFFON, although at certain times the missiles have borne serial numbers. Those missiles which were paraded in November 1963 and May 1964 bore serial numbers; those seen in November 1964, May 1965, and November 1965 did not.

The two GRIFFON variants can be easily differentiated by noting substantial differences between the transporter which carries each variant. GRIFFON (I) is

carried by a transporter which exhibits four and probably five handwheels located in the area of the booster-sustainer junction. Four of these handwheels are located below the transporter and the fifth protrudes from the right side of the large vertical yoke, or saddle, which supports the forward portion of the booster (Figure 1A). In this respect, the transporter for GRIFFON (II) varies considerably. In place of five handwheels, this transporter appears to have only one. In addition, the booster support structure consists of a heavy horizontal block, on top of which is a smaller yoke which actually cradles the booster (Figure 1B).

The differences between booster support structures and the number of handwheels on the two transporters are significant for purposes of identification. They can be observed from either side of the missile, in most cases, and can also be observed from some distance. Photography of the GRIFFON extending over a period of two and one half years, including five Moscow Parades, has been analyzed, and no exceptions to the missile variant-transporter type combination have been observed.

GRIFFON MODIFICATIONS - BOOSTER SECTION

External variations between GRIFFON (I) and GRIFFON (II) occur on both the booster and sustainer sections of the missiles. Arbitrarily, the booster section is presented first. Differences which are apparent on the booster are as follows:

1. A modification to the booster locking mechanism. On GRIFFON (I) the booster locking mechanism attaches to a heavy plate which appears to be riveted to the sustainer (Figure 2A). These heavy plates are missing on GRIFFON (II), and the locking mechanism appears to fasten directly into openings in the skin of the sustainer section (Figure 2B).

2. A difference in the number of access plates on the right side of the frontal section of the booster. GRIFFON (II) contains an extra access plate which is not present on GRIFFON (I) (compare Figures 2A and 2B).

3. On the left side of the frontal section of the booster, GRIFFON (II) again exhibits an access plate which is not present on GRIFFON (I) (Figures 3A and 3B).

4. A difference in the location of a horizontal weld seam on the right side of the booster. This difference is particularly noticeable when the location of the seam is related to the location of the booster fins. Note that the seam is much closer to the lower right booster fin on GRIFFON (II) than it is on GRIFFON (I) (Figures 4A and 4B).

5. A difference in the number of access plates visible on the right rear portion of the booster. Immediately below the upper right booster fin on GRIFFON (II) is a small access plate which lies contiguous to the rear edge of the circular weld seam in this location. GRIFFON (I) has no such access plate (compare Figures 5A and 5B).

6. A variation in the location of horizontal weld seams on the left side of the booster. The two horizontal weld seams on the left side of the GRIFFON (I) booster are located much closer to the lower left booster fin than on GRIFFON (II) (Figures 6A and 6B).

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GRIFFON MODIFICATIONS - SUSTAINER SECTION

The modifications which occur on the sustainer section of GRIFFON are distributed over the entire length of this section. They consist of the following:

1. A probable difference in the rearward extending projection which is located below and behind the trailing edge of the upper control fin. Photography of [] reveals that this projection on GRIFFON (I) is bifurcated, and partially encompasses a circular access plate (Figure 7A). On corresponding photography of GRIFFON (II) (Figure 7B), this projection appears to extend laterally to either side. From available photography it cannot be conclusively determined whether a circular access plate is present in this area on GRIFFON (II) or not however, it is believed that the plate is present.

It is interesting to note (Figure 8A and 8B) that there is no difference in this feature on the GRIFFONS which were paraded one year later (May 1965). The circular access plate is clearly visible on each variant and has a large, crude, substantial handle attached. The left side of this extension is indented to accommodate another access plate which is common to both GRIFFON variants.

2. Immediately above the leading edge of the left control fin on GRIFFON (II), is a raised elliptical projection which does not appear on GRIFFON (I) (compare Figures 9A and 9B). This projection does not appear to be constructed in a manner which would permit its being readily removed.

3. A difference in the location of a circular indentation on the left side of the sustainer. Immediately in front of the rear restraining strap on the left side of GRIFFON (I) are two circular indentations which are located side by side, although not tangent to each other (Figure 9A). On GRIFFON (II), one of these indentations has been relocated and is positioned immediately above the trailing edge of the left sustainer wing (Figure 9B). The difference in the locations of these indentations is one of the easiest methods of differentiating the GRIFFON variants when viewed from the left side.

4. GRIFFON (I) has a raised projection located just ahead of, and above, the upper left, long linear channel on the sustainer (Figure 10A). On GRIFFON (II) there is no raised projection in this location, however one does appear approximately midway between the long linear channel and the shorter channel in front of it (Figure 10B).

5. GRIFFON (II) has a small raised projection located approximately midway between the lower right, long, linear channel and the shorter channel in front of it (Figure 11B). GRIFFON (I) displays no such raised projection (Figure 11A).

6. On GRIFFON (II) the large access plates located immediately behind the nose section each have four large studs (Figure 12B). These studs apparently do not act as fasteners since the screws which secure the plates are still present. These large studs are not present in this location on GRIFFON (I) (Figure 12A).

GRIFFON NOSE SECTION ANALYSIS

Photographic analysis of the GRIFFON nose section revealed no noticeable difference in this section between the two missile variants. The type of material from which this nose section is constructed could not be determined, although it appears to be a shiny, highly reflective substance. It also appears to be opaque, which would preclude the observation of longerons or other internal structural members, if such exist.

The "lines" or "striations" within this nose section (Figure 13A), are believed to result from reflections. This in turn could perhaps result from the method and/or the material from which the nose section is constructed.

These "lines" or "striations" are not believed to be an integral part of the nose structure itself, since they begin to disappear when the nose section is viewed at closer range (Figures 13B, 14A, and 14B).

Color photography of GRIFFON, accomplished during the May 1965 Moscow Parade reveals that the color of the GRIFFON nose is a deep blue, regular in tone. It is possible that this color has a functional significance; all of the missiles photographed with color photography were decorated with colorful trim (red predominating) however the only blue observed anywhere among the parade missiles was the GRIFFON nose section.

MENSURAL COMPARISONS BETWEEN GRIFFON VARIANTS

With two GRIFFON variants obviously in existence, it became necessary to determine whether any mensural differences existed between the two. This was accomplished using a ratio technique. A ratio was derived by measuring the size of a component part or section, in terms of the size of another component part from the same variant. This ratio was then compared to the ratio derived by performing the same operation, using the same component parts of the other variant.

For example: the length of the nose section of GRIFFON (I) could be determined in terms of the overall length of the sustainer, producing the ratio nose length over sustainer length. This same determination of nose length over

sustainer length would be made for GRIFFON (II). The resulting ratios could then be compared to determine whether the relative sizes were the same. At this point the actual size of the various components was not of interest. The object of this exercise was the determination of any relative differences between the two variants.

A total of fifteen representative component sizes were selected for comparison, comprising both linear and lateral dimensions. Each of these dimensions is indicated by a single asterisk on the line drawing in Figure 15. After a careful comparative process using the technique described above, it was determined that the two GRIFFON variants were identical in size.

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DETAILED MENSURATION - GRIFFON MISSILE

Having determined that both GRIFFON variants were identical in size, the NPIC/Technical Intelligence Division was further requested to produce detailed mensuration of GRIFFON, using the improved metrical data base which is now available. A detailed explanation of this data base and the other techniques which render the dimensions in this report extremely reliable are presented below.

This mensural effort has produced dimensions (Figures 15-21) for GRIFFON which are significantly different from those produced previously by NPIC and other members of the intelligence community. The overall length of GRIFFON, including nose probe, is now determined to be 53.96 feet. This is an increase of from 0.7 feet to 1.8 feet over previous figures produced by U.S. agencies. It is similar, however, to the length overall figure published by [redacted]

Two types of dimensions are presented here which were not previously available. The first of these, shown in Figure 16, are the detailed

dimensions relating to the GRIFFON nose probe. The second, shown in Figure 17, are the dimensions presented for the nose section. These include the diameter of the nose, computed at consistent intervals, and the chord angle at each point where the diameter has been computed. The chords themselves are not portrayed in Figure 17 since they lie so close to the curve, in most cases, as to become partially obscured and confusing. An equation for the curvature of the ogive could not be determined accurately within the available time, and thus could not be presented.

Dimensions have not been presented in this report for the cross-sectional configuration of the wings and fins, or for those features which constitute the airframe variations which are compared in the first 12 figures. In spite of a much improved metrical data base, it is believed that insufficient data can be derived from the available photo and metrical sources for compilation of the true engineering drawings which would be necessary to portray these features accurately. Such drawings are normally produced in an engineering environment, where access to background data, and to the hardware itself, is unrestricted.

MENSURATION TECHNIQUES UTILIZED IN THIS REPORT

The dimensions presented in this report are believed to be extremely accurate, primarily for two reasons. First, two reliable methods for obtaining basic metrical inputs were utilized -- the "bridge" technique, and the "metrical trap" technique. Each of these provides a strong solution in itself; however, to produce the mensuration shown in this report, both methods were compared and the strongest inputs from the combination were accepted. Neither of these methods were available to NPIC at the time of the original GRIFFON mensuration. A brief description of these two techniques is presented here.

The "bridge" technique relies upon photographs of the subject missile which are taken as it crosses the Krivskiy Bridge in Moscow. Accurate dimensions of this bridge are available, taken from the builder's specifications. By means of an analytical solution which allows for any camera distortion, and for the position of the missile relative to the positions of the known objects within the bridge structure, very accurate basic dimensions can be determined for the missile. These, in turn, are utilized to produce the remaining dimensions.

Several of the major dimensions of the GRIFFON missile, as determined by both methods, are shown here to illustrate the high degree of correlation between the two methods.

	Bridge Method	Trap Method	Difference	Percentage Discrepancy
GRIFFON - Overall Length	53.9 feet	54.3 feet	0.4 feet	01.8 percent
GRIFFON - Sustainer Length	39.1 feet	39.1 feet	0.0 feet	00.0 percent
GRIFFON - Wing Length	10.4 feet	10.51 feet	0.11 feet	01.1 percent
GRIFFON - Sustainer Diameter	2.8 feet	2.77 feet	0.03 feet	00.1 percent
GRIFFON - Booster Diameter	3.5 feet	3.47 feet	0.03 feet	00.9 percent

The second factor which has provided greatly increased accuracy was the much larger number of photographs which have become available since the time of the original GRIFFON mensuration. For the current effort, photography from five Moscow parades was available, whereas photography from only one parade was available for the original mensural effort. Not only has the volume increased, but the quality of the photography, both from the standpoint of resolution and photogrammetric aspects, was greatly improved in the more recent parades. Thus, each dimension presented in this report has been computed on from five to fifteen photographs. The mean of these dimensions, in each case, is the dimension presented.

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DIMENSIONAL ACCURACY

The dimensional accuracy is presented as a percent error. This value was obtained for each dimension by comparing the mean ratio value with the maximum and minimum value obtained by the various methods.

One of the causes of measuring error on photography is the difficulty of determining the endpoints of the object being measured. This means that the same amount of linear error will result in a larger percentage error for the smaller dimensions. With this in mind, the percent error statements below are shown by dimension category as well as in one group:

A. Composite of all Dimensions

1. Maximum error - 30 percent
2. Average error - 5 percent*
3. 95 percent of the dimensions - error is 10 percent or less
4. 90 percent of the dimensions - error is 8 percent or less
5. 80 percent of the dimensions - error is 5 percent or less
6. 50 percent of the dimensions - error is 2 percent or less

B. Dimensions of Less than One Foot

1. Maximum error - 30 percent
2. Average error - 8 percent**

C. Dimensions Less than 3 Feet, But Greater than .99 Feet

1. Maximum error - 10 percent
2. Average error - 4 percent

D. Dimensions of 3 Feet or Greater

1. Maximum error - 8 percent
2. Average error - 3 percent

All mensuration in this report was performed by photogrammetrists of the NPIC/Technical Intelligence Division.

REFERENCES

PHOTOGRAPHY

[redacted] photography from Moscow Parades of November 1963, May 1964, November 1964, May 1965, and November 1965 SECRET [redacted]

DOCUMENTS

NPIC. R-1115/64, Revised Mensural Data on GRIFFON Surface-To-Air Missile, February 1964 (SECRET)

AFSC. Foreign Technology Division, Line Drawing #64-E-1042, November 1964 (CONFIDENTIAL)

AFSC. Foreign Technology Division, Photo Analysis Report #64-58, November 1964 (CONFIDENTIAL)

U.S. Army Missile Command MIS 25-64, Antimissile Missile System: GRIFFON, June 1964 (SECRET)

[redacted]
GRIFFON Missile Analysis, May 1964 (SECRET)

[redacted]
Memorandum No. 36, Soviet Surface-To-Air Missile GRIFFON, March 1964 (SECRET)

REQUIREMENTS

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C-SI4-81,610

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* One twentieth (5 percent) of the errors were 10 percent or greater. Excluding these the average error was 3 percent.

** Excluding those errors which were 10 percent or greater, the average error would be 4 percent.

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FIGURE 1-A -- GRIFFON (I)
(Short arrows indicate handwheel locations;
long arrow indicates booster support yoke)

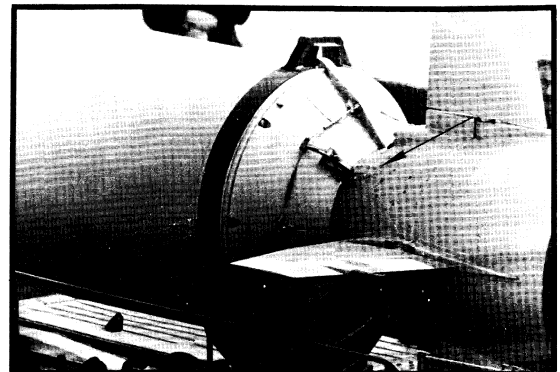


FIGURE 2-A -- GRIFFON (I)
(Arrow indicates heavy rivetted plate)

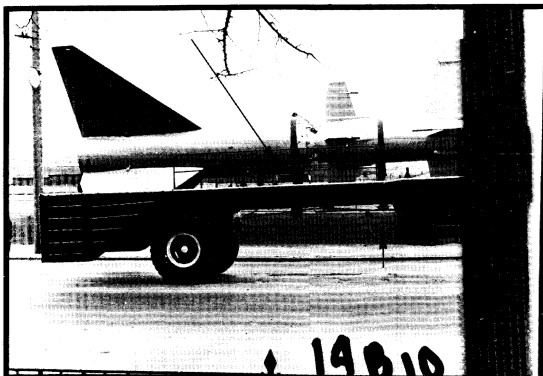


FIGURE 1-B -- GRIFFON (II)
(Short arrow indicates handwheel location;
long arrow indicates booster support yoke)

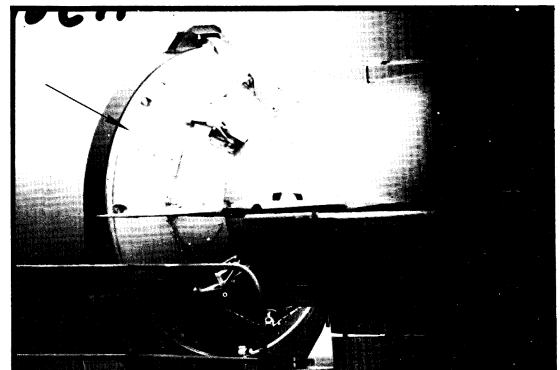


FIGURE 2-B -- GRIFFON (II)
(Arrow indicates additional access plate)

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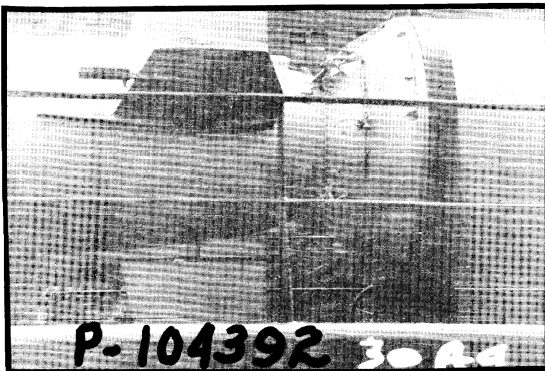


FIGURE 3-A -- GRIFFON (I)

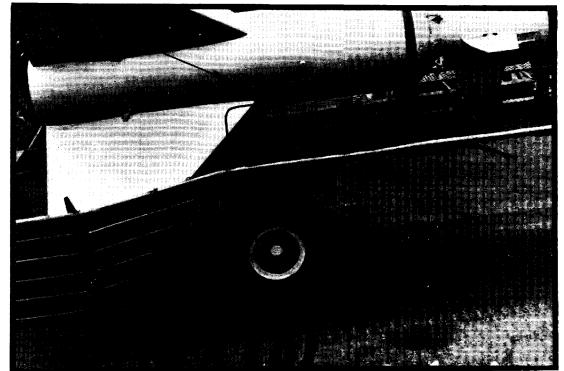


FIGURE 4-A -- GRIFFON (I)
(Note location of horizontal weld seam)

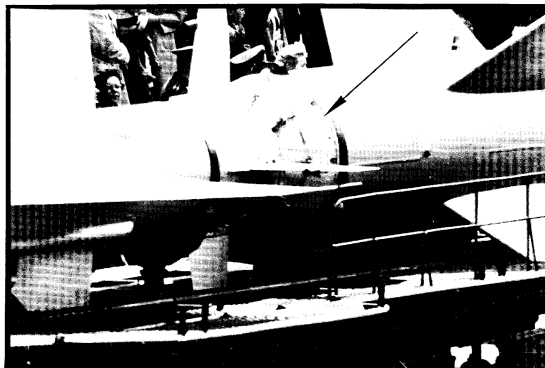


FIGURE 3-B -- GRIFFON (II)
(Arrow indicates additional access plate)

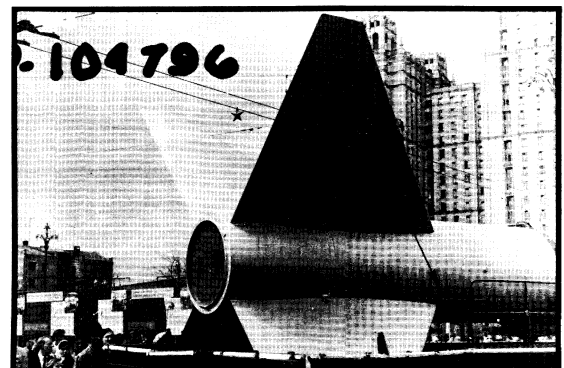


FIGURE 4-B -- GRIFFON (II)
(Note difference in location
of horizontal weld seam)

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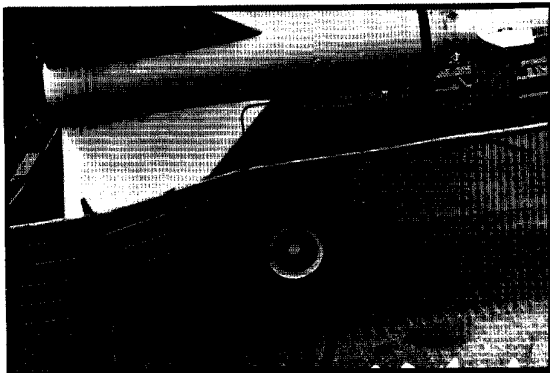


FIGURE 5-A -- GRIFFON (I)

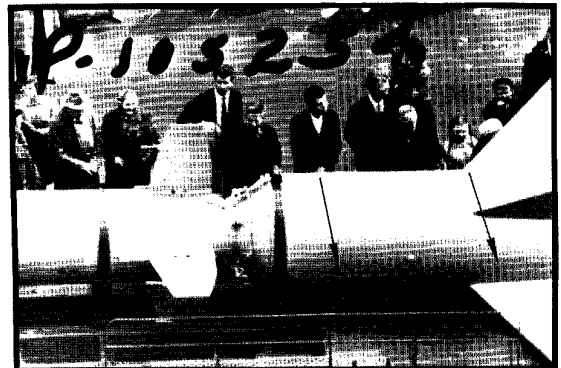


FIGURE 6-A -- GRIFFON (I)
(Note location of horizontal weld seam)

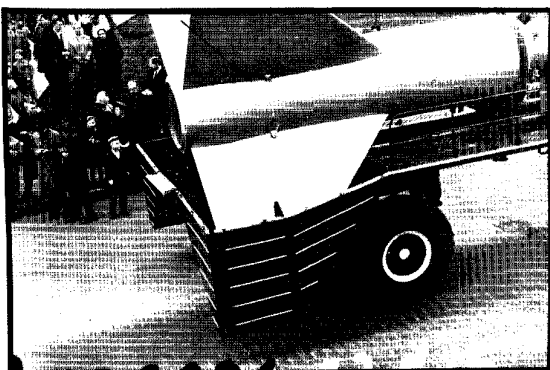


FIGURE 5-B -- GRIFFON (II)
(Arrow indicates additional access plate)

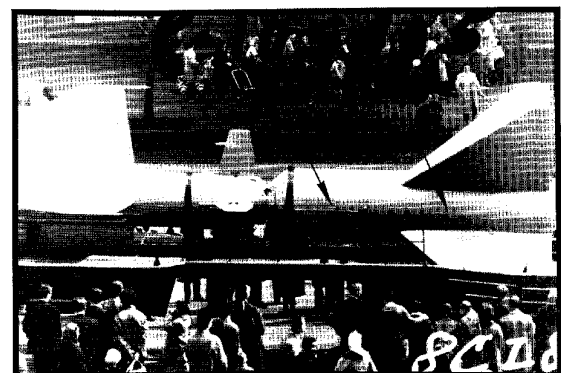


FIGURE 6-B -- GRIFFON (II)
(Note difference in locations
of horizontal weld seams)

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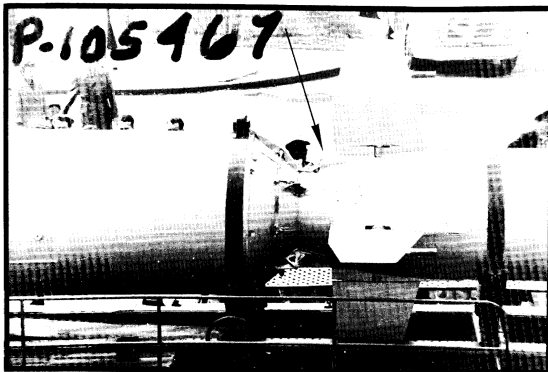


FIGURE 7-A -- GRIFFON (I)
(Note rearward projection which
partially encompasses access plate)

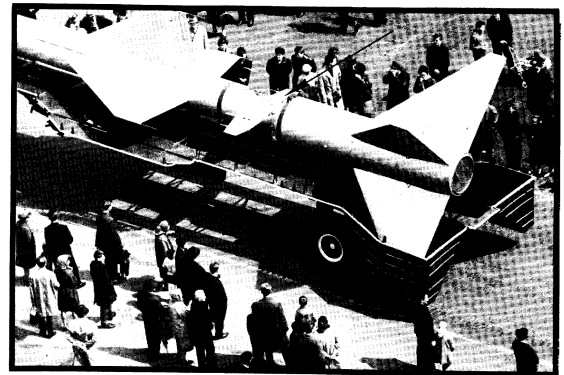


FIGURE 8-A -- GRIFFON (I)
(Arrow indicates rearward extension and
access plate)

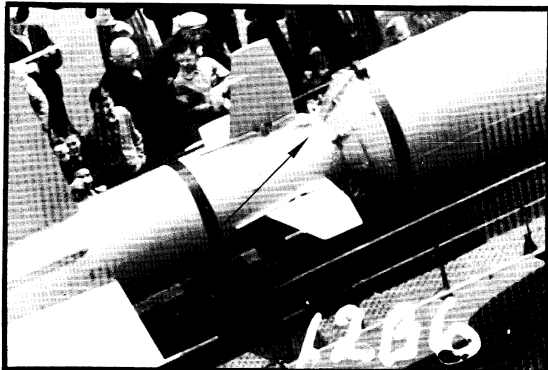


FIGURE 7-B -- GRIFFON (II)
(Note lateral extension to rearward projection)

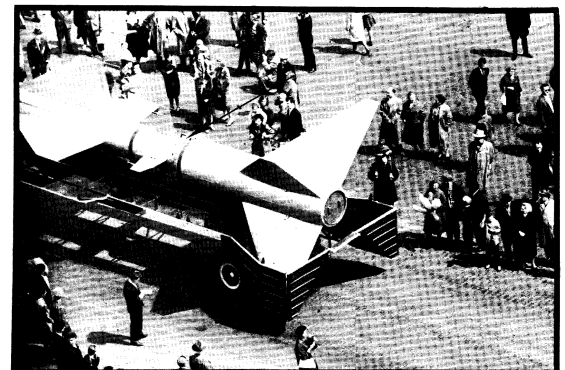


FIGURE 8-B -- GRIFFON (II)
(Arrow indicates rearward extension and
access plate)

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FIGURE 9-A -- GRIFFON (I)

(Note absence of raised projection
above left control fin; arrows indicate
circular indentations)



FIGURE 10-A -- GRIFFON (I)

(Note location of raised projection)

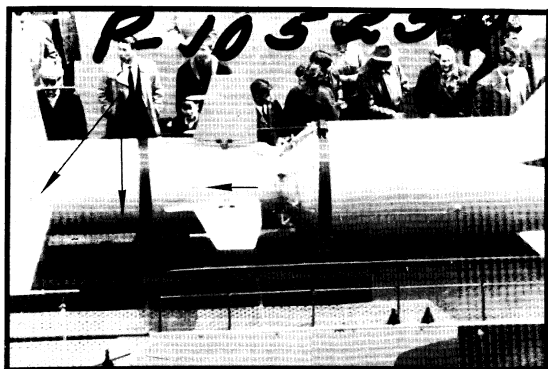


FIGURE 9-B -- GRIFFON (II)

(Short arrow indicates raised projection;
long arrows indicate circular indentations)



FIGURE 10-B -- GRIFFON (II)

(Note location of raised projection)

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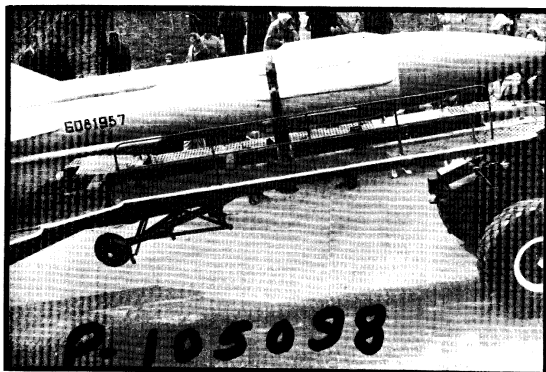


FIGURE II-A -- GRIFFON (I)

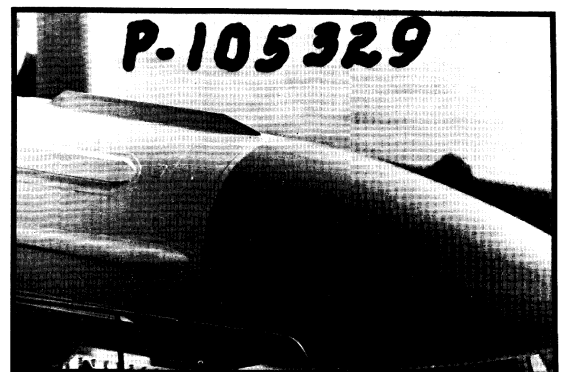


FIGURE I2-A -- GRIFFON (I)



FIGURE II-B -- GRIFFON (II)

(Note raised projection)

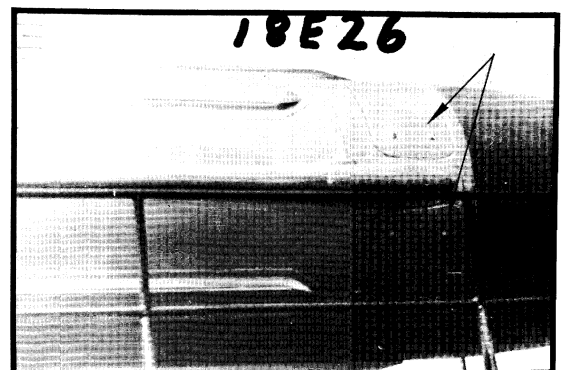


FIGURE I2-B -- GRIFFON (II)
(Note the four large studs located
on each access plate)

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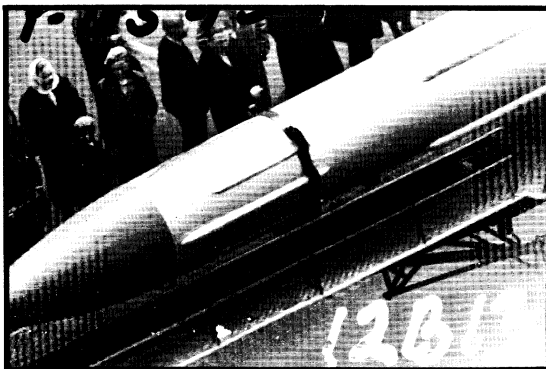


FIGURE 13-A -- GRIFFON NOSE SECTION

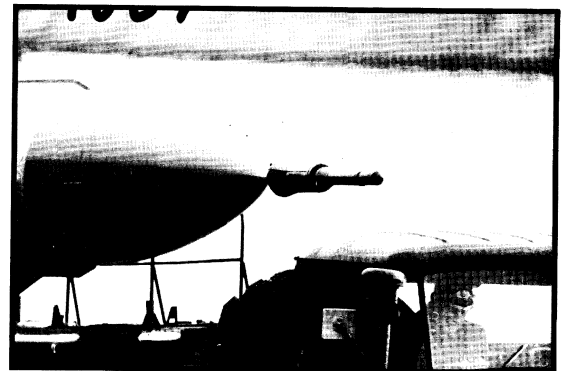


FIGURE 14-A -- GRIFFON NOSE SECTION



FIGURE 13-B -- GRIFFON NOSE SECTION



FIGURE 14-B -- GRIFFON NOSE SECTION

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GRIFFON MISSILE - MAJOR DIMENSIONS

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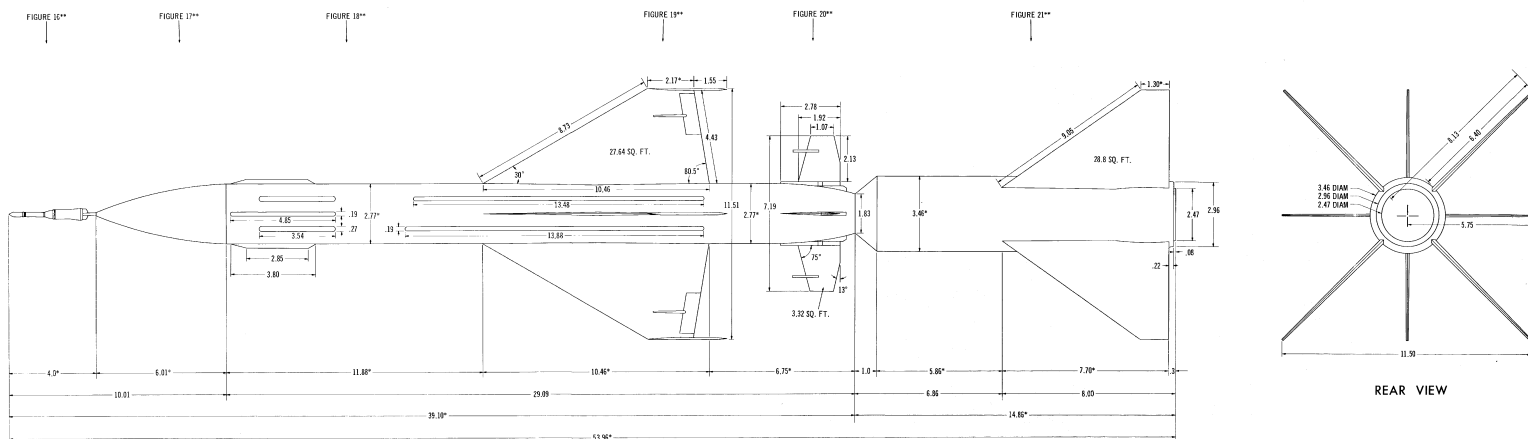


FIGURE 15

NOTE: All linear dimensions are expressed in feet.
The cross-sectional presentation of the fins and wings is representative and is not drawn to scale; with this exception, the drawing is to scale.

* Indicates those representative dimensions where the two Griffon variants were compared.
** Indicates appropriate figure where this section is enlarged to show detailed dimensions.

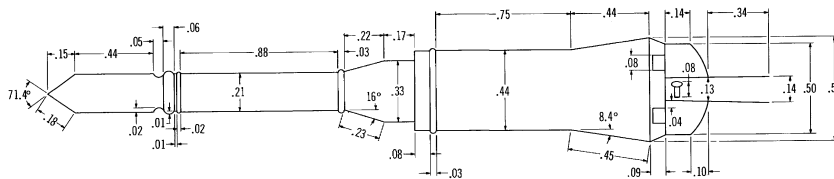
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GRIFFON MISSILE - NOSE PROBE (DETAILED DIMENSIONS)



OVERALL LENGTH 4.0'

FIGURE 16

NOTE: All linear dimensions are expressed in feet.
This is a scaled drawing.

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GRIFFON MISSILE-NOSE SECTION (DETAILED DIMENSIONS)

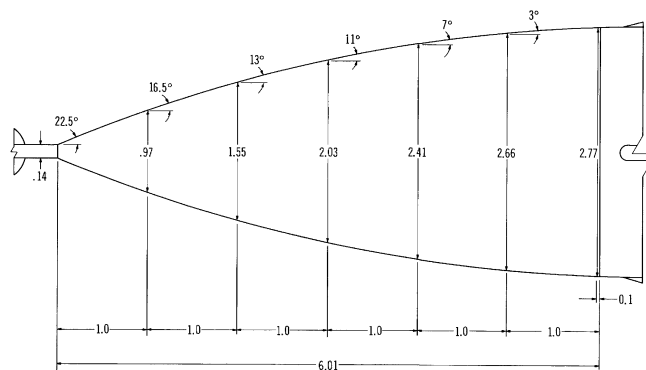


FIGURE 17

NOTE: All linear dimensions are expressed in feet.
This is a scaled drawing.

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GRIFFON MISSILE-FORWARD SUSTAINER AREA (DETAILED DIMENSIONS)

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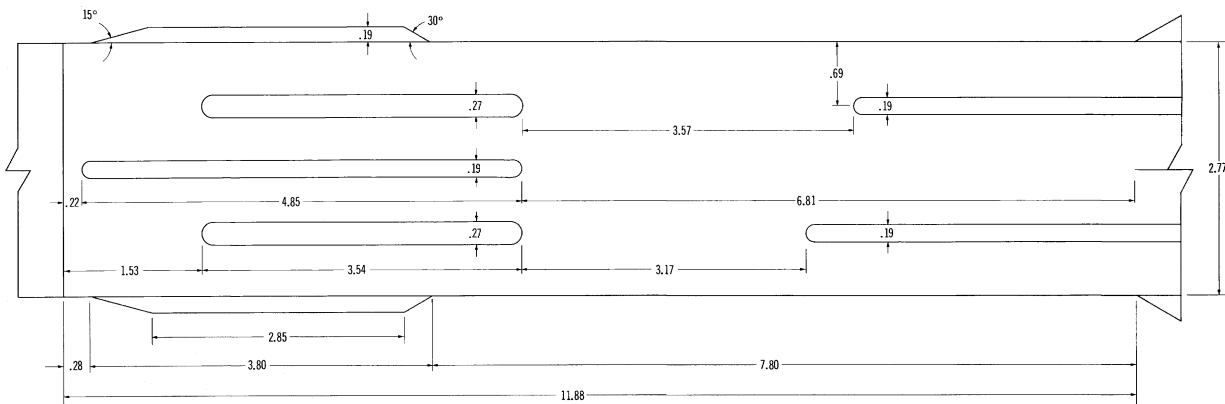


FIGURE 18

NOTE: All linear dimensions are expressed in feet.
This is a scaled drawing.

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Technical drawing of a roof structure. The main roof section is a triangle with a base of 10.46, a height of 2.77, and a slope of 30°. The area of this section is 27.64 SQ. FT. The roof is composed of two materials: a top layer (1.05) and a bottom layer (1.90). The total width of the roof is 1.05 + 1.90 = 2.95. The roof is supported by a wall with a height of 11.5. The wall has a base of 2.17 and a top of 3.72. The area of the wall is 1.25 SQ. FT. The roof is supported by a wall with a height of 11.5. The wall has a base of 2.17 and a top of 3.72. The area of the wall is 1.25 SQ. FT.

FIGURE 19

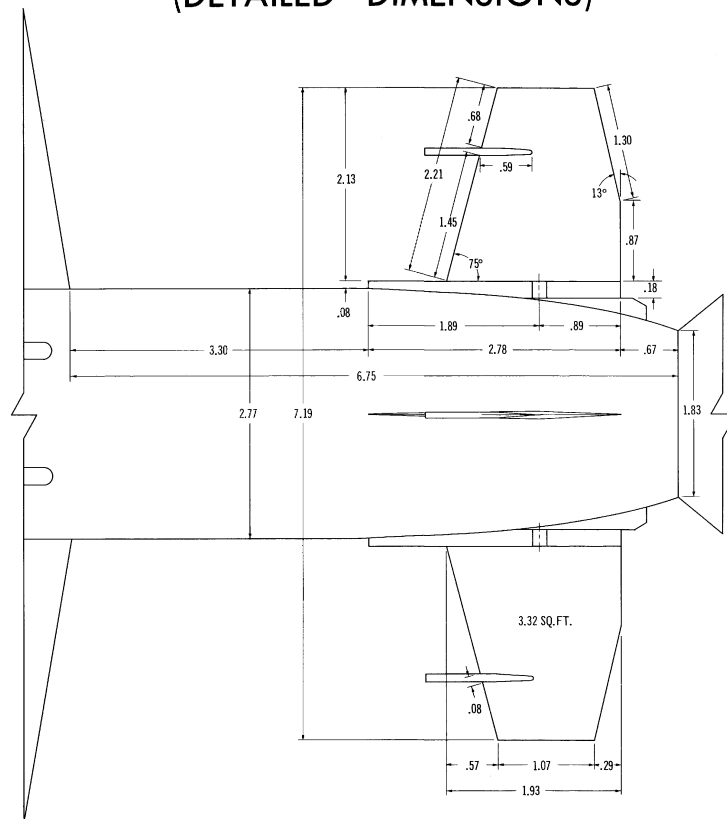
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SECRET

GRIFFON MISSILE - CONTROL FIN AREA (DETAILED DIMENSIONS)

CIA/PIR-61109



NOTE: All linear dimensions are expressed in feet.
The cross-sectional presentation of the fins
is representative and is not drawn to scale,
with this exception, the drawing is to scale.

FIGURE 20

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25X1

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GRIFFON MISSILE - BOOSTER SECTION (DETAILED DIMENSIONS)

CIA/P1R-61109

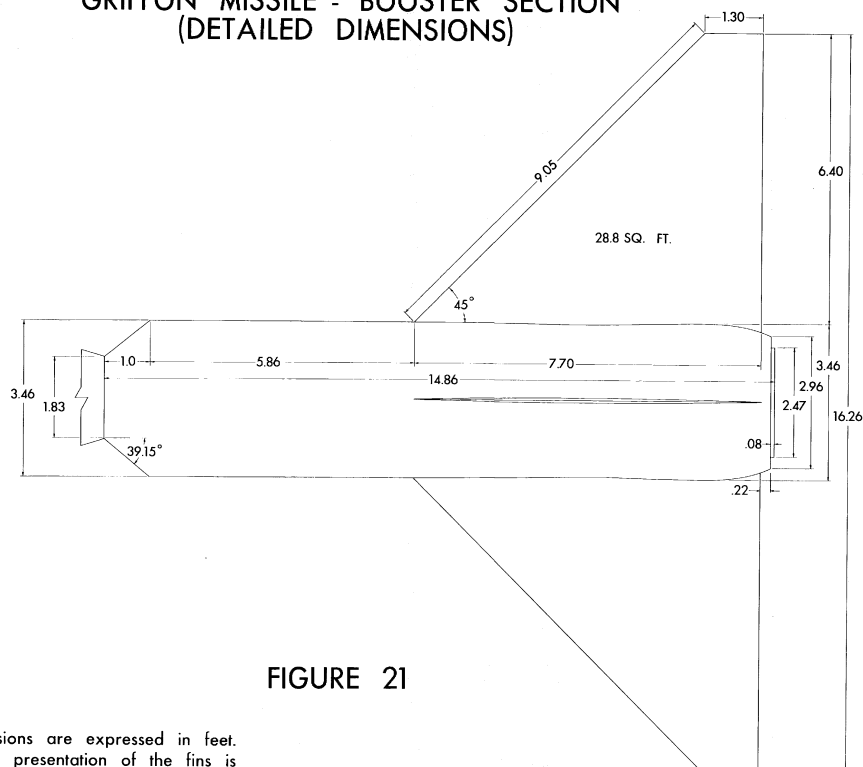


FIGURE 21

NOTES: All linear dimensions are expressed in feet.
The cross-sectional presentation of the fins is representative, and is not drawn to scale; with this exception, the drawing is to scale.

SECRET

25X1

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